

Zion-Mount Carmel Highway, Pine Creek Bridge  
(Pine Creek Bridge)  
Spanning Pine Creek  
Zion National Park  
Springdale vicinity  
Washington County  
Utah

HAER No. UT-39-B

HAER

UTAH

29-SPDA-V

3B-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record  
Rocky Mountain Regional Office  
National Park Service  
Department of the Interior  
P.O. Box 25287  
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

Zion-Mount Carmel Highway, Pine Creek Bridge  
(Pine Creek Bridge)

HAER No. UT-39-B

HAER

UTAH.

27-SPDA-V.

3B -

Location: Zion National Park  
Springdale vicinity, Washington County, Utah

Date of Construction: 1930

Original Use: Highway bridge

Present Use: Highway bridge

Significance: Built of native sandstone and ashlar masonry, and designed to compliment its natural surroundings, this bridge is a superb example of "National Park Service-Rustic" stone bridge engineering. It is unaltered and retains structural integrity.

Researcher: James Jurale  
September 27, 1984

Zion-Mount Carmel Highway, Pine  
Creek Bridge (Pine Creek  
Bridge)  
HAER No. UT-39-B  
(Page 2)

In February 1923, Thomas C. Vint, Chief Landscape Engineer, and Mr. Angwin, Bridge Engineer from the National Park Service Regional Office, made inspections of the bridge sites on the Zion-Mount Carmel Highway, which was in the process of construction by the U. S. Bureau of Public Works. Work on the Pine Creek Bridge, which was under the ultimate supervision of Chief Thomas H. MacDonald, lagged behind highway construction due to design difficulties. Although the bridge was opened for traffic at the Zion-Mount Carmel Highway dedication ceremony on July 4, 1930, it was not completed until late that month.

The Pine Creek Bridge, a masonry arch type constructed of native sandstone, is located at the base of the six switch backs which wind up Pine Creek Canyon to the tunnel on the Zion-Mount Carmel Highway. The structure is made entirely of Navajo sandstone with a cemented rubblestone core. The crossing at Pine Creek is 120 feet in length and 30 feet in width. The predominate structural theme is represented in the key-stoned arch which spans the creek. The barrel of the arch, constructed with a massive supporting key in the upper center, is 60 feet long and 23 feet high.

The precision of stonework is made even more impressive by the skillful blending of blocks of several different colors and shades of colors in the arch and side walls. Tan, brown, red, pink, purple, and some green tones are found in the hand-hewn rock. These vary, in turn, with the intensity of light provided by the moon and sun to make this structure one of the most beautiful found in Zion National Park.

According to L. Dewey Exell, a master stonemason and 23-year National Park Service employee who worked on the bridge, narrow gauge rails for a motorized winch were built adjacent to the uncompleted bridge. "What they did was pick the rocks up over here and they'd swing it out and let it down to wherever we had a place for the rocks. We got (quarried) stone a month before we started laying."

#### Bibliography

Exell, Dewey. Interview by Kathy Andrews, 1982, ZNHA.

Scoyen, E. T. "ZNP Annual Report for 1930."

Scoyen, E. T. "ZNP Superintendent's Monthly Reports," February, October 1928.

#### Representation in Other Surveys

Olivieri, Lance. "Classified Structure Field Inventory Report, 1978."

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY,  
PINE CREEK BRIDGE  
Spanning Pine Creek on Zion-Mount Carmel Highway  
Zion National Park  
Springdale vicinity  
Washington County  
Utah

HAER NO. UT-39-B

HAER  
UTAH  
27-SPCA.V,  
3B-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service

P.O. Box 37127  
Washington, D.C. 20013-7127

HISTORIC AMERICAN ENGINEERING RECORD

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY, PINE CREEK BRIDGE  
Zion National Park  
HAER No. UT-39-B

HAER  
UTAH  
27-SPDA.V,  
3E-  
(p 3)

Location: The bridge is located along the Zion-Mount Carmel Road, 0.6 miles east of the North Fork Virgin River Bridge, Springdale vicinity, Washington County, Utah.

UTM: 12/325670/4120460  
USGS Quad: Springdale East, UT

Dates of Construction: 1929-1930

Type of Structure: Vehicular bridge

Use: Vehicular bridge

Designer/Engineer: U.S. Department of Agriculture, Bureau of Public Roads; U.S. Department of the Interior, National Park Service.

Builder: Reynolds-Ely Construction Company, Springville, Utah.

Owner: National Park Service.

Significance: The Pine Creek Bridge is significant for its association with the Zion-Mount Carmel Highway, constructed by the National Park Service and Bureau of Public Roads in 1927-30. The highway is listed on the National Register of Historic Places and is considered significant in the contexts of tourism and engineering. The bridge is an integral and necessary component of the highway, and is also significant for its rustic style, designed to harmonize with the local setting.

Project Information: Documentation of the Pine Creek Bridge is part of the National Park Service Roads and Bridges Recording Project, conducted in the summer of 1993 under the co-sponsorship of Zion National Park and HABS/HAER.

Michael F. Anderson, HAER Historian, August 1993.

#### INTRODUCTION

The 25-mile long Zion-Mount Carmel Highway connects southern Utah's principal north-south transportation arteries: Interstate 15 and Highway 89. Completed in 1930, it immediately served a number of regional transportation needs, including an all-weather road from Kane County and other points east of the Wasatch mountain range to the nearest railhead at Cedar City, and a well-graded modern highway for the growing number of tourists to southern Utah. Pine Creek Bridge is one of two bridges required at the beginning of the highway to carry the roadway above Pine Creek Canyon to the switchbacks and Zion Tunnel above.

#### HISTORICAL CONTEXT

Popular needs and demands for better east-west transportation in southern Utah lagged fifty years behind the earliest settlement in the region. Mormon colonizers migrating south from Salt Lake City had settled the Virgin River Valley and Zion Canyon by the early 1860s, but for several generations had more pressing concerns than construction of a road to the east. Cattle ranching and subsistence farming in the semiarid high desert region kept the settlers busy close to home, while trade and communication typically led west and north whence the pioneers had come: to the string of towns connecting the western boundary of the Mormon State of Deseret.

By the turn of the twentieth century, citizens of Rockville and Springdale immediately west of Zion Canyon had satisfied their few needs for access to the high plateau country. John Winder, a settler in the region since the 1880s, had improved an old Southern Paiute Indian trail to the east rim which served cattlemen as well as operators of the Zion cableworks--the astonishing aerial tramway built in 1901 to transport lumber from the rim to the valley below. The road leading to the base of this trail at the lower cableworks (today's Weeping Rock area) was little more than a set of wagon ruts to be sure, but sufficed for driving cattle between summer and winter ranges and for moving lumber and supplies to and from the cable system.

Demands for better roads, not only in the Zion region but everywhere in the United States, awaited the dawn of the automobile age. As the nation awoke to the scenic splendors of the American West and coincidentally fell in love with the automobile, motor enthusiasts lobbied in varied ways for better conduits to the national parks and forests. Motorists and businessmen alert to the possibilities of tourism first raised the cry in southwestern Utah in the 1910s, and it was not long before the State of Utah and the federal government responded

A detailed black and white map of Zion National Park. The map shows the park's boundaries, major roads like Highway 63 and Highway 89, and various landmarks including the Visitor Center, Picnic Area, and several trails. A scale bar at the bottom indicates distances up to 1 mile.

INDEX TO SHEETS		
Sheet No.	Description	Reference to Building
1	Title	PLAN 1000
2	Layout	" "
3	Plan	77-1000 100-500
4	Gallery #1	Draw 12-0 230 -
5	Gallery #2	Draw 12-0 231 -
6	Gallery #3	Draw 12-0 232
7	6-12-L Drawings	Draw 12-0 233-4

[illegible]INDEX MAP  
SCALE OF MILES

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY,  
PINE CREEK BRIDGE  
HAER No. UT-39-B  
(page 6)

with a decades-long program to improve transportation to and within Zion National Park.

A number of factors combined by 1920 to argue for a road passing through Zion National Park and connecting Highway 91--the "Arrowhead Trail"--25 miles to the west with Highway 89 equidistant to the east. Population and business growth in Kane County argued for an all-season, all-weather road across the north-south mountain range (the Hurricane Fault region) to the nearest railhead at Cedar City, Utah. Development of local scenic wonders--Zion, Cedar Breaks, Bryce Canyon, and North Rim of the Grand Canyon--and the emergence of a circle tourism route which connected the nascent parks suggested a shorter more scenic vacation if a road could be built through Zion. These factors, and a growing desire among locals for tourist dollars, led to the location, survey, and construction of the Zion-Mount Carmel Highway in the years 1923-1930.

#### LOCATION AND DESIGN

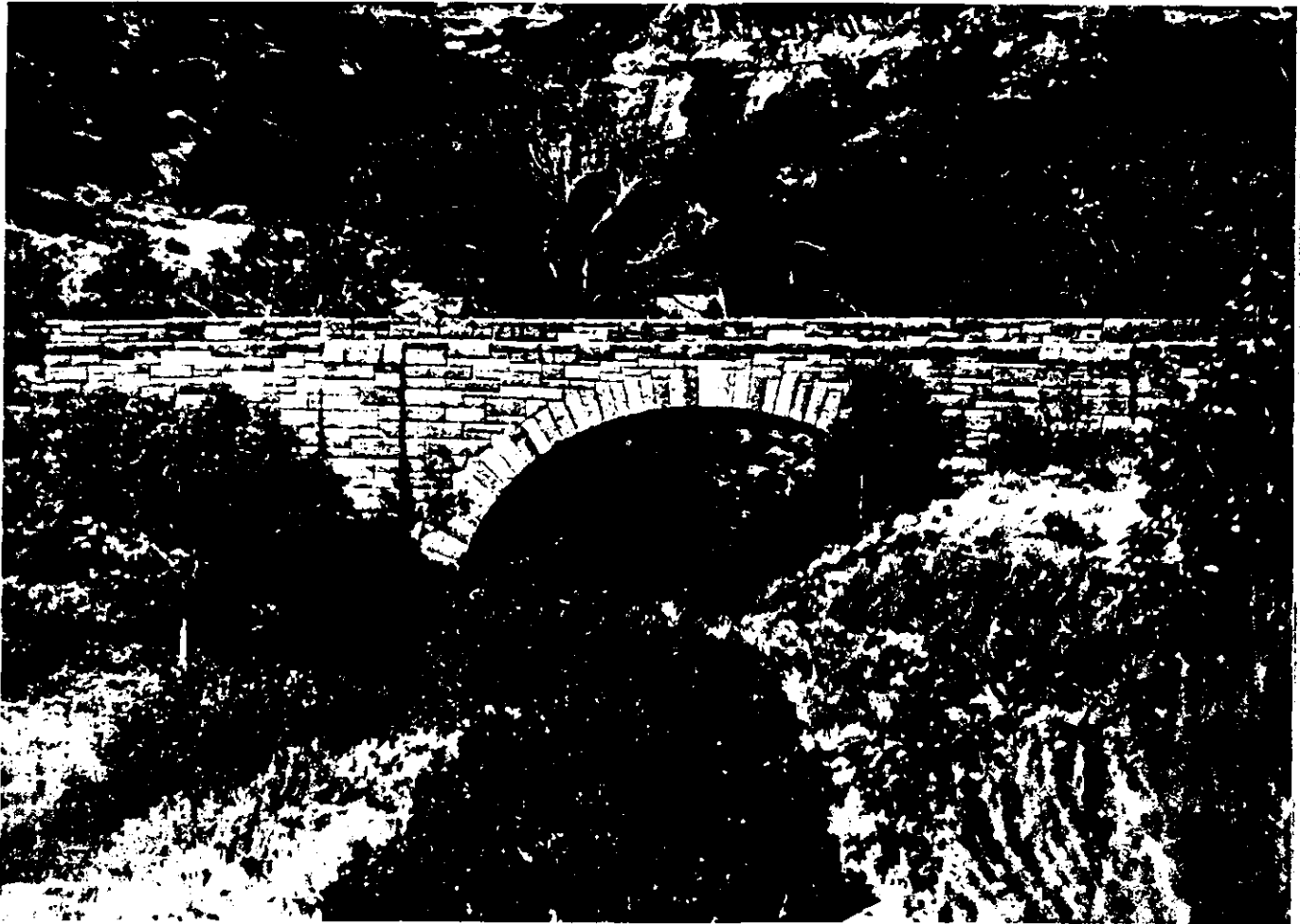
The preliminary location of the Zion-Mount Carmel Highway completed by Bureau of Public Roads (BPR) Highway Engineer R. R. Mitchell in late 1925 contemplated use of the existing bridge over the Virgin River, approximately 1000' upstream of the park's south checking station. The road would proceed from that point up the north talus slope of Pine Creek Canyon to the base of the Great Arch. Had Mitchell's location been chosen, neither the Pine Creek Bridge nor the North Fork Virgin River Bridge would have been built.<sup>1</sup> As it turned out, unsatisfactory grades, lines, and tunnel plans of Mitchell's location led to another investigation in June 1926, and a resurvey in November 1926. This resurvey resulted in the location eventually followed, which required the placement of bridges spanning the North Fork Virgin River, and Pine Creek, 0.6 miles upstream of its mouth, where the road would cross to the south side of Pine Creek Canyon and proceed up the slope to the tunnel site.<sup>2</sup>

---

<sup>1</sup> R. R. Mitchell, Associate Highway Engineer, "Location Report Zion Park-Mt. Carmel Road: Zion Park Section," manuscript, 1926, Zion Tunnel and Road Reports File, Park Administrator's vault, Zion National Park (ZNP), 3.

<sup>2</sup> R. A. Brown, Associate Highway Engineer, "Final Construction Report on East Rim Road Route #1," manuscript, 1931, Zion Tunnel and Road Reports File, Park Administrator's vault, ZNP, 7-9.

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY,  
PINE CREEK BRIDGE  
HAER No. UT-39-B  
(Page 7)



Pine Creek Bridge facing upstream -- 1993 (Zion NP archives)

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY,  
PINE CREEK BRIDGE  
HAER No. UT-39-B  
(page 8)

Soon after the BPR completed the resurvey, NPS Associate Landscape Engineer Thomas C. Vint studied the lower portion of the new route with BPR Highway Engineer B. J. Finch. His letter to the NPS director in February 1927 touched on the subject of bridges. Vint indicated that the men had discussed the topic at length and debated the question of whether to build "rustic" concrete bridges, which the contractor could build immediately and use during construction, or build "sand stone faced arch type" bridges, which would cost at least \$100,000 more than the former. Vint decided that the rustic type was adequate from a aesthetic point of view and suggested their use, however, when the contracts were let nearly two years later a sandstone type bridge prevailed for the Pine Creek Bridge while a steel girder span with timber siding and rails was chosen for the North Fork Virgin River Bridge.<sup>3</sup>

The BPR requested bids for construction of the North Fork Virgin River and Pine Creek bridges on 30 July 1928. Five firms responded and the BPR recommended award to C. F. Dinsmore of Ogden, Utah, who submitted the low bid of \$180,731. The Secretary of Interior rejected all bids, however, perhaps because the engineer had estimated only \$174,290 and the department rarely awarded bids exceeding its own estimated costs. On 23 July 1929, the BPR again requested bids for the same structures under new designs, and on August 30th the Secretary awarded the contract to the Reynolds-Ely Construction Company of Springville, Utah for the low bid of \$136,918.12.<sup>4</sup>

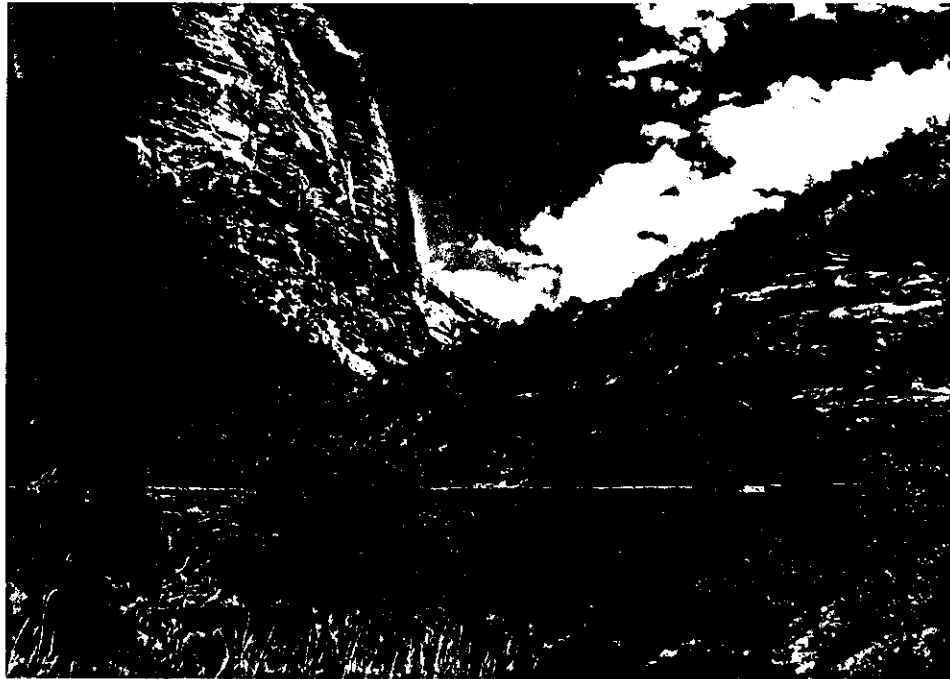
The new design for Pine Creek's bridge apparently called for the sandstone structure seen today, but it is difficult to explain the engineer's lower estimated cost (\$155,820) in light of Vint's letter of February 1927 concerning costs. Vint labored over the new design and ultimately constructed a scale model from bars of soap to get it the way he wanted it. Specifications described a 60' span, masonry, keystone arch supported by concrete piles and footings. Spandrel and wing walls were to be reinforced concrete faced with masonry. The rise of the arch would measure 23' 1" and reinforced concrete tie beams would span transversely above the arch from spandrel to spandrel.<sup>5</sup>

---

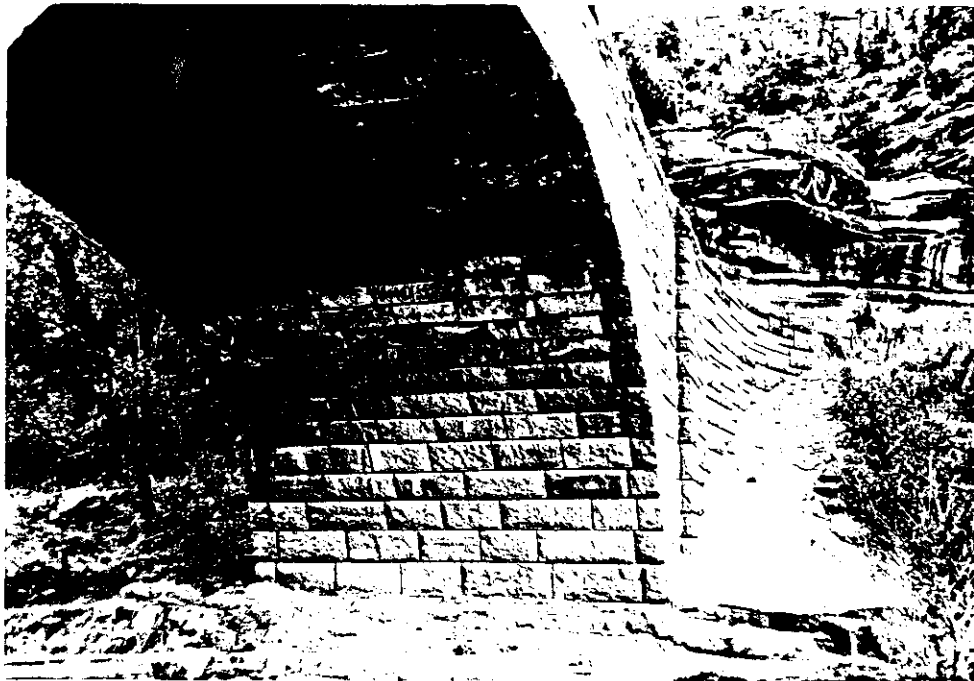
<sup>3</sup> Thomas C. Vint, NPS Landscape Architect, to the Director, letter, 2 February 1927, Zion Codex, ZNP Library.

<sup>4</sup> Brown, "Final Construction Report," 16-17.

<sup>5</sup> Brown, "Final Construction Report," 16-17, 58; Garate, "The Zion Tunnel," 46-47.



Pine Creek Bridge with East Temple in background.  
Facing upstream -- 1993. (Author's photograph)



Solid masonry arch, masonry facia spandrel and  
wing walls, and drainage gutter -- 1993.  
(Courtesy of Todd Croteau)

#### HISTORY OF CONSTRUCTION

The contractor arrived on-site and began work on a camp, opening of a rock quarry, and concrete aggregate production by 26 September 1929.<sup>6</sup> Crews began excavation for concrete footings November 10th, using a P & H shovel equipped with a clam shell. Because he expected to encounter heavy boulders when driving the pre-cast piles on the south side of Pine Creek, the contractor instead excavated the entire footing to bedrock, cast the piles in place, and backfilled around them. Excavation proved a costly and time-consuming task because bedrock was somewhat lower than expected and, at least once, protective cribbing failed and a flood on Pine Creek backfilled the still incomplete excavation. The contractor succeeded in driving 120 wooden piles (a change order from concrete to wooden piles approved) measuring from 35'-46' in length on the north side of the creek. All piles were driven to refusal at bedrock. The BPR approved a concrete cellular foundation for the south side, and crews completed pouring it as well as concrete footings for both sides by 21 April 1930. This marked completion of all work below the spring line of the arch.<sup>7</sup>

The contractor stockpiled quarried rock at the construction site well before masonry work began, and setup a travelling crane (or "motorized winch") to convey concrete and rock to be placed above the spring line. Crews began laying the ashlar masonry and pouring the cemented rubblestone core on 27 April and completed the task 10 July. They started pouring concrete above spring line for spandrel walls and tie beams May 11th and finished on 28 June. Additional concrete wing walls with a masonry facade were placed between 15 July and 22 August 1930, the latter date marking completion of the project.<sup>8</sup>

Deviations from specifications during construction included widened fills adjacent to the bridge to provide a parking area, the change in pilings and footings previously noted, excavations approximately 10' deeper than anticipated to reach bedrock, waterproofing tie beams, and changes to the wing walls to run parallel to the centerline of the road. The completed roadway width measured 24', and received a clay subgrade topped with an

---

<sup>6</sup> Brown, "Final Construction Report," 58.

<sup>7</sup> Brown, "Final Construction Report," 59-61.

<sup>8</sup> Brown, "Final Construction Report," 60-61; James Jurale, "Classified Structure Field Inventory Report," HAER No. UT-39 Zion-Mount Carmel Highway Field Records, 1984.

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY,  
PINE CREEK BRIDGE  
HAER No. UT-39-B  
(page 11)

oil-mixed gravel wearing course. Including engineering costs, the bridge's cost to the government totalled \$72,947.95.<sup>9</sup>

Periodic inspections by 1957 had revealed spalling and cracking on some concrete portions of bridges within the park. These problems were thought to be the result of freezing and thawing as well as "alkali reactive aggregates," and that the deterioration might be slowed by the application of hot linseed oil and paint. Despite the deterioration, the superintendent concluded that they were in "fairly good condition" considering their age. The inspection reports probably referred to the nearly all concrete bridges built by the State of Utah on the east side of the park which, by 1993, had deteriorated to the point where they had to be replaced.<sup>10</sup> There is no evidence that the Pine Creek Bridge has been altered since its completion in 1930.<sup>11</sup>

---

<sup>9</sup> R. R. Mitchell, Senior Highway Engineer, "Final Inspection Report," attached to Brown, "Final Construction Report"; "Financial Statement, East Rim Road, 1-A1, Bridges-#1675," attached to Brown, "Final Construction Report."

<sup>10</sup> ZNP Superintendent's Monthly Narratives, March, 1957, history boxes, ZNP archives.

<sup>11</sup> Utah Department of Transportation, "Structural Inventory and Appraisal Sheet: National Bridge Inventory--Structure Inventory and Appraisal," UDOT main office, Salt Lake City, Utah. The inventory notes no reconstruction nor alterations since completion in 1930.

## DESCRIPTION

From the North Fork Virgin River Bridge, the Pine Creek Bridge is approached along the easy gradient of the Zion-Mount Carmel Highway's first roadway line. This line initially passes through a narrow canyon just upstream of the creek's mouth. As the canyon opens up, one's attention is drawn first to Mount Spry and the nearly sheer cliff of the East Temple, then to the Great Arch of Zion to the right. Vision drops from the Great Arch down to Pine Creek Canyon where the bridge is first noted, spanning the creek at the base of low sandstone cliffs. A slightly different but essentially similar view is obtained on the descent from the switchbacks. Cottonwoods along the creek and the harmonious blend of masonry sandstone partially obscure the structure, but most will note it in time to pull off at the small, north side parking lot.

Close up, one notes that the bridge's straight span forms the tangent of a broken back curve, only one of several such hazardous curves along the entire 25-mile long highway. Although the roadway was widened at each end of the bridge and the bridge deck built to a 30' width to ease this condition, the turn into the curve is sharp and motorists--especially those descending along the switchbacks--sometimes scrape the masonry wing walls. Bridge features not mentioned earlier include rock-lined gutters on the southwest side of the bridge and weep holes at the base of the arch to provide adequate drainage from the runoff of nearby cliffs. Pilasters frame the arch and intentionally hide expansion joints, while the red-tinted asphalt wearing course now covers original curbs astride the guardrails. Masonry is of rough-surfaced ashlar.<sup>12</sup>

Many visitors to Zion National Park do stop to admire the near features and exceptional beauty of the Pine Creek Bridge. The entire structure is 120' long, with the massive supporting key of the 60', 23'-high arch focusing the admirer's attention on the varied shades and colors of the Navajo sandstone. Sandstone arch construction intentionally mimics the Great Arch of Zion upstream. A skillful blend of tan, brown, red, pink, purple, and green tones vary constantly with the sun's angle, making this structure one of the most beautiful in southwestern Utah. Reports of the time attributed the fine result to the general superintendent on the job, "who took great pride in the work done under his supervision and was inclined to incorporate into the work a greater degree of refinement than actually specified."

---

<sup>12</sup> Descriptions are from field observations of June and July, 1993.

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY,  
PINE CREEK BRIDGE  
HAER No. UT-39-B  
(page 13)

Unfortunately, his care and attention resulted in penalties for late delivery and contributed to the contractor's \$21,000 loss for the overall bridge project.<sup>13</sup>

---

<sup>13</sup> Jurale, Field Inventory Report; Brown, "Final Construction Report," 61-63; ZNP Superintendent's Annual Report, 1930, history boxes, ZNP Archives.

BIBLIOGRAPHY

Anderson, Michael F. Field observations, June-July, 1993.

Brown, R. A. "Final Construction Report On East Rim Road Route #1." Manuscript, 1931.

Garate, Donald T. "The Zion Tunnel: From Slickrock to Switchback." Undated manuscript.

Jurale, James. "Classified Structure Field Inventory Report." HAER No. UT-39, 1984.

Mitchell, R. R. "Location Report Zion Park-Mt. Carmel Road: Zion Park Section." Manuscript, 1926.

Utah Department of Transportation. "Structural Inventory and Appraisal Sheet: National Bridge Inventory--Structure Inventory and Appraisal." Coded inventory sheet, [1993]

Vint, Thomas C. Letter to the Director, National Park Service, 2 February 1927.

ZNP Superintendent's Annual Report, 1930.

ZNP Superintendent's Monthly Narratives, March 1957.

ADDENDUM TO  
ZION-MOUNT CARMEL HIGHWAY, PINE CREEK BRIDGE  
Zion National Park Roads and Bridges  
Spanning Pine Creek on Zion-Mount Carmel Highway  
Springdale Vicinity  
Washington County  
Utah

HAER NO. UT-39-B

HAER  
UTAH  
27-SPDA.V  
3B.

XEROGRAPHIC COPIES OF COLOR TRANSPARENCIES

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service  
Department of the Interior  
P.O. Box 37127  
Washington, D.C. 20013-7127